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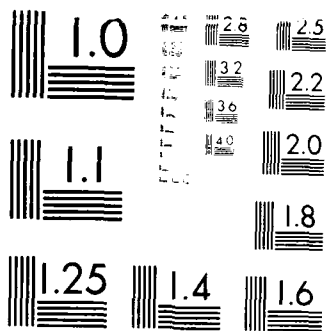
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WAVE AND FRACTURE PHENOMENA
IN
IMPACTED CERAMICS

S. Winkler

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Contract Number DAJA45-88-C-0011

1st Periodic Report

December 1987 - February 1988
Item No. 0001

Prepared for
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(1) Statement of Work

An optical measuring technique in combination with high speed photography is provided to solve the problem of this contract, the investigation of wave and fracture phenomena in opaque ceramic materials. Surface disturbances caused by these mechanical events will deflect reflected light from its ordinary direction and thus give rise for shadow patterns which can be photographed. Specimens with the dimensions 100mm by 100mm by 10mm shall be impacted on one of the smaller surfaces by a projectile in order to generate these events. One of the two larger surfaces has to be flat and smooth like an optical mirror for the application of the optical method. It is, therefore, a major task within this contract and the first step of the investigation procedure, to develop preparation methods to achieve a reflecting surface on each specimen. It is, however, expected that different materials require different polishing techniques for example because of their different hardnesses. The light reflecting power will also not be sufficient for the purpose of high speed registration with most materials. In this cases it is provided, therefore, the polished surface being coated by a thin metal layer in order to increase its reflectivity.

A specimen of boroncarbide (B_4C) with the desired dimensions has been made available by MTL, Watertown, for preliminary studies. The hardness of this material, however, is very high so that special techniques have to be applied. After some trials with directly available means which did not lead to the intended results a machining program (grinding, lapping etc.) has been started using diamond tools only. Work on this is still not completed since parts of these techniques are not yet established.

In parallel to this work it has also been intended to prepare specimens of alumina, for it is believed that with this material results can be obtained easier than with boroncarbide. Attempts, however, to receive samples of a special material from MTL have not been successful yet. Consequently, some specimens of alumina have been purchased from a German company. These are presently in the preparation phase. Also in this case these procedures have been started with grinding to get plane surfaces. Lapping and polishing will follow.

(2) Research Plans for Remainder of the Contract Period

To achieve a surface comparable to an optical mirror just polishing the ceramic material will in general not be sufficient for lack of reflectivity of the material. The next step, therefore, after having completed this machining work will be coating the polished surface by a very thin metal layer to increase the reflectivity of the surface.

In the succeeding step the sensitivity of the optical method has to be tested or improved in preexperiments. Small spheres will be utilized for projectiles and low impact velocities of the order of 100 m/s in order not to break the expensive specimens in these pretests. Wave phenomena, however, should be observable.

The main experiments will be carried out when the specimen preparation procedures have been established and the measuring technique has been proved working well.

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